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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/890,455	03/12/2002	Hiroaki Inoue	2001-1091A	3064
513	7590	04/13/2005	EXAMINER	
WENDEROTH, LIND & PONACK, L.L.P. 2033 K STREET N. W. SUITE 800 WASHINGTON, DC 20006-1021			GURLEY, LYNNE ANN	
			ART UNIT	PAPER NUMBER
			2812	

DATE MAILED: 04/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary

Application No.

09/890,455

Applicant(s)

INOUE ET AL.

Examiner

Lynne A. Gurley

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 January 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 5-9, 18-21, 23, 24, 26-30 and 32-35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 5-9, 18-21, 23-24, 26-30 and 32-35 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

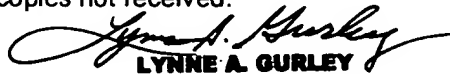
Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.


LYNNE A. GURLEY

PRIMARY PATENT EXAMINER
TC 2800, AU 2812

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This Office action is in response to the RCE filed 1/12/05 and, to the now entered after-final amendment, filed 12/22/04.

Currently, claims 5-9, 18-21, 23-24, 26-30 and 32-35 are pending.

Drawings

1. The drawings were received on 8/25/03. These drawings have been approved by the Examiner.

Specification

2. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 112

3. Claims 5-9, 18-21, 23-24, 26-30 and 32-35 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for endocrine disruptors "at a concentration ranging from 1 to 100 mg/L" (specification, page 5, lines 19-25. Also, see page 4, lines 17-24 for solutions which are considered to be endocrine disruptors, which are the same solutions being added to Applicant's process on page 4, lines 17-24 and page 6, lines 11-25, and page 9, lines 22-27), the specification does not reasonably provide enablement for the method being "conducted without any...endocrine disruptors" as Applicant has amended the claims to

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reflect. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to fabricate the invention commensurate in scope with these claims.

4. Additionally, there seems to be a discrepancy in that page 7, lines 1-3 states that “compounds added to the electroless copper plating liquid according to the present invention are not endocrine disruptors, and do not disturb the ecosystem”. On the one hand Applicant has supplied the same endocrine disruptor solutions, in the process of the instant application, as used in the conventional prior art, but, at the same time, Applicant has stated that “compounds added to the electroless copper plating liquid according to the present invention are not endocrine disruptors, and do not disturb the ecosystem”. Clarification is required.

5. Additionally, while Applicant states that the EDTA 4H (complexing agent) and TMAH (organic alkali) contain no alkaline metals (page 6, lines 2-8), which **prevents** alkali metals from being introduced into the plated copper film, on page 10, lines 10-14 and in Figures 1 and 2, Applicant states and shows that the amounts of alkaline metal in the present invention are only **smaller** than the amounts of alkaline metal in the conventional plating liquid. Finally, on page 12, lines 1-7, Applicant states that since the pH adjustor has no alkali metal content, the copper interconnection structure has a **reduced** alkaline metal impurity in the plated film. There appears to be some discrepancy here as well. Applicant claims “the method is conducted **without any** alkaline metals”. If this is so, then where is the alkaline metal content coming from which produces only a **smaller** or **reduced** alkaline metal content? If the solution contains alkaline metals, but in reduced quantities, then Applicant must be specific in noting which additives to the solution do not contain the alkaline metals. Clarification is requested.

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6. In light of the preceding 35 USC 112 rejection, the prior art rejections remain as follows:

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

8. Claims 5-6, 8, 18 and 20-26 are rejected under 35 U.S.C. 102(e) as being anticipated by Cheung et al. (US 6,258,233, dated 7/10/01, filed 7/9/99).

Cheung shows the method as claimed as depositing a seed layer in a feature of a substrate, depositing an electroless conductive layer conformally on the seed layer and electroplating a layer over the electroless layer to fill features on the substrate (column 3, lines 53-57). The electroless deposited copper layer fills defects and discontinuities in the seed layer (column 2, lines 42-46). The seed layer and the electroless deposition layer are both copper and, the copper sulfate in solution, which contains hydrogen and oxygen (copper sulfate produces dihydric copper ions in H₂O as described in the specification of the instant invention) and disassociates into copper ions. A complexing agent of EDTA is used. An aldehyde acid is used – formaldehyde or glyoxylic acid. An organic alkali (TMAH) is used. (See column 3, lines 50-67 and column 4, lines 1-58.) The electroless deposition is performed at a rate of 400 Angstroms per minute (40 nm/min) (column 4, lines 54-55).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

11. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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12. Claims 7, 19, 27-32 and 33-35 (new) are rejected under 35 U.S.C. 103(a) as being unpatentable over Cheung et al. (US 6,258,233, dated 7/10/01) in view of Kikuchi et al. (US 4,563,217, dated 1/7/86).

Cheung shows the method as claimed and as described in the previous paragraphs.

Cheung lacks anticipation only in not teaching: 1) the details of the polyoxyethylene series surface active agent; 2) that the inlet size of the recess is less than 0.18 micron; 3) the concentration of copper ions from 0.01 to 10.0 g/L; 4) the concentration of the EDTA * 4H being 0.5 to 100 g/L; 5) the glyoxylic acid concentration being 1 through 50 g/L and; 6) the pH being adjusted to a range of 10-14.

Kikuchi particularly shows, in a method using an electroless copper plating solution, details of the polyoxyethylene series surface active agent in the dependent claims. Also, the formation of cupric ions is reinforced by $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ in Kikuchi, as taught in the specification of the instant invention. Kikuchi also teaches the concentrations of the copper ions, the EDTA, the glyoxylic acid and the pH range.

It would have been obvious to one of ordinary skill in the art to have used the polyoxyethylene series surface active agent, and to have used the copper ions, the EDTA, the glyoxylic acid and the pH range as claimed in the method of Cheung, with the motivation that these ranges are reasonable for an electroless plating solution, as taught by Kikuchi.

Additionally, it would have been obvious to one of ordinary skill in the art to have had an inlet size less than 0.18 micron, with the motivation that Cheung already shows deposition in a contact hole, so that the size of the opening being less than 0.18 micron as technology is scaling

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to the submicron ranges would be reasonable, especially in that the process taught in Cheung yields excellent, enhanced results for such a structure.

Response to Arguments

13. Applicant's arguments filed 1/12/05 have been fully considered but they are not persuasive. In response to Applicant's remarks, considering the comprising language in the preamble of the claim, and the description cited on page 6, lines 2-8 which states that the complexing agent does not contain alkali metals, the Examiner maintains the rejection based on the fact that the specific EDTA 4H is not claimed in the independent claim and the reference does not speak to the issue of alkaline metals, which would enable, in a broad interpretation, the family of EDTA to be used in the invention. Additionally, considering the comprising language, and using a broad interpretation of the claim language, some of the solution does not contain endocrine disruptors. Additionally, Applicant has some discrepancy as to whether the solution of the instant invention contains endocrine disruptors and alkaline metals, or not, as mentioned in the 35 USC 112 rejection previously.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynne A. Gurley whose telephone number is 571-272-1670. The examiner can normally be reached on M-F 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt can be reached on 571-272-1873. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Lynne A. Gurley
Primary Patent Examiner
TC 2800, Art Unit 2812

LAG
April 4, 2005